inhalation therapy

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April 1961
Volume 6 Number 2

IN THIS ISSUE

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For better

Understanding

Part I of a II part series on

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JOURNAL OF THE AMERICAN ASSOCIATION OF INHALATION THERAPISTS

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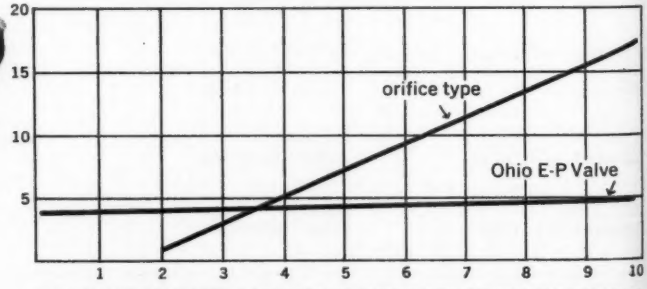

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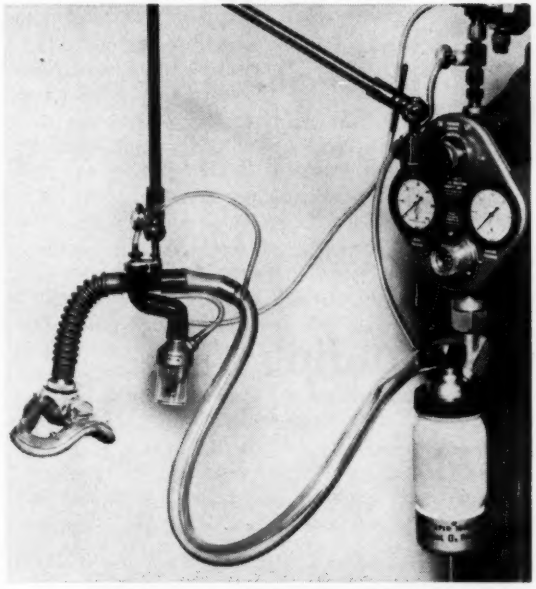

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Diseases of the Chest, Oct. 1958, Vol. XXXIV, No. 4.

Pulmonary Emphysema:
Hurley L. Motley, MD.
Missouri Medicine, June 1960, pp 701-709.

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Editorial

For Better Understanding

WITH THE ADVENT of Registry, certain misunderstandings have arisen which can only be attributed to a failure of communications.

Sometimes communications fail because people are inarticulate and have difficulty in expressing their thoughts clearly. At other times, information may be withheld deliberately, not maliciously, but because the situation does not justify releasing information.

Certainly there is nothing inarticulate about the announcement describing Registry which appeared on pages 14 and 15 of "Inhalation Therapy" for December, 1960.

Nor can any one be blamed for withholding information, since it was only business-like and ethical to withhold the official announcement of the Registry Corporation until such time as it was a legal entity, that is, a not-for-profit corporation in the State of Illinois.

One of the copybook maxims which I often read to my students at Northwestern University is this: "the aim of good writing is not only to make oneself understood, but to make oneself incapable of being misunderstood."

So in the space allotted to me by Editor Jim Whitacre, I wish to present a few facts which may lessen the existing confusion, and may create greater understanding.

To begin with, the fact that you are a member of the A.A.I.T. does not mean that you are automatically a Registered Inhalation Therapist, nor that you qualify for Registry without taking an examination.

Let me repeat that another way: A.A.I.T. Membership does not equal A.R.I.T. Membership.

On pages 14 and 15 of our journal for December, 1960, is a clear explanation of the American Registry of Inhalation Therapists, prepared by physicians and by inhalation therapists who are members of the Board of Trustees of the American Registry of Inhalation Therapists.

This announcement states that the American Registry of Inhalation Therapists is a not-for-profit Illinois Corporation, sponsored by the American College of Chest Physicians, the American Society of Anesthesiologists, and the American Association of Inhalation Therapists.

Clearly defined on these pages you will find the objectives of the A.R.I.T., the qualifications necessary for taking the examination, the fees, and the examination schedules.

Also listed are the nine members of the Board of Trustees of the American Registry of Inhalation Therapists.

If after reading this material you have any questions about applications, qualifications, examinations, fees, etc., I suggest that you write to the Registrar, whose name and address are given.

If you have questions about anything else, or if you are concerned about the fee structure, the method of procedure, the policies, then I suggest that you write to the President of the A.R.I.T. Board of Trustees.

To avoid further misunderstanding, let it be clear that the A.A.I.T. and the A.R.I.T. while related, are, nevertheless, separate and distinct organizations.

While it is true that the Executive Director and the Board of Directors and the Advisory Board of the A.A.I.T. worked to establish Registry, it is also true that the policies and operation of the new not-for-profit corporation are independent of the A.A.I.T.

This attempt to clarify our relationship must not be taken as a dismissal of our responsibilities; nor must any one get the impression that your Executive Director or your Board Members are in any way disgruntled. Nor does it mean that we do not wish the A.R.I.T. every success.

It does mean that with the Registry Corporation a fact. Inhalation Therapy is coming of age, and that qualified Inhalation Therapists will at last be given the status and recognition which their training, experience, and dedication warrant.

It means, too, that we can look forward to increased professional standards for all members of the A.A.I.T. as they grow in skill, knowledge, and stature, and become Registered Inhalation Therapists.

To the A.A.I.T.'ers who have expressed their concern at having to take an examination, may I point out that this is standard procedure for any professional group. In other words, membership in the parent association, the A.A.I.T., is considered a first step, and then, after further training and the acquiring of more knowledge, the A.A.I.T. Member takes an examination to improve his professional status.

Furthermore, all Inhalation Therapists who advance themselves to the status of "Registered Inhalation Therapist" will not only enhance the reputation of inhalation therapy, but in so doing will gain the respect and approval of similar paramedical groups, doctors, hospital administrators, and others. So that the stiff requirements (so-called) rather than hurting our cause, will, on the contrary, help it.

In closing, I wish to ask a favor of all A.A.I.T.'ers.

First, that you remain open-minded about the Registry until it has had a chance to prove itself.

Second, that if you get a chance to thank any of the nine members of the A.R.I.T. Board of Trustees, you do so. Very few people realize or appreciate the amount of work and time spent by these doctors and inhalation therapists in the establishment of this Registry Corporation.

Third, that you remain professional-minded so that the A.A.I.T. need never regret having had you as a member.

Fourth, that you never forget the only justifiable motivation for the existence of both the A.A.I.T. and the A.R.I.T.—and that is, *improved care of the patient.*

—Albert Carriere,
Executive Director
American Association of Inhalation Therapists

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Resuscitation of the Newborn: Part I

Fetal circulation differs from that of the adult

by **Paul R. Knox, LCDR, MC, USN***

During the period of gestation, the fetal circulatory system is by far the most important one—since the placenta is the fetal organ of respiration—the lungs have no physiological function until birth.

"Oxygenated" blood (64-80% saturated) returns to the fetus from the placenta via the umbilical vein, passes through the ductus venosus to the inferior vena cava and hence to the right atrium. (It might be mentioned that this blood from the placenta is mixed with the venous blood in the inferior vena cava, so actual oxygen content is even less by the time it reaches the heart.) Most of this "oxygenated" blood passes through the foramen ovale to the left atrium, then to the left ventricle and out the aorta—so the heart and brain are supplied with arterial blood that is relatively richer in oxygen as compared to that supplied to the rest of the body. The blood returning from the upper part of the body enters the right atrium via the superior vena cava, mixing in the right atrium only very little, thence passes to the right ventricle and then out the pulmonary artery. Most of this blood is shunted from the lungs via the ductus arteriosus to be mixed with the "oxygenated" blood in the descending aorta. Blood returns to the placenta via the umbilical arteries—which are continuations of the hypogastric arteries. Most of this fetal circulation has been substantiated fairly recently by experimental work, although this pathway of fetal circulation was described as early as 1790.

Dr. Knox is on active duty in the Navy, but is assigned for postgraduate work to Duke University Medical Center, where he is an Associate in Anesthesia.

The common theory is that lungs during fetal life receive very little blood, but recently the lungs of full term fetuses were found to be highly vascular, containing more than 5% of the total fetal blood volume, and the pulmonary capillaries were found to be of significant calibre.

Actually the pulmonary capillary bed is usually well developed by the 27th week of gestation and is capable of functioning.

At full term, about a quarter of the total blood volume is found in the placenta and the rest in the fetus—about 100 ml in the placenta and about 310 ml in the fetus. About 2/3 to 3/4 of the blood in the placenta can be returned to the fetus if the cord is not clamped immediately at birth.

Fetal blood has an oxygen-carrying capacity of 21.5 volumes %; however, the "oxygenated" blood returning to the fetus is somewhere between 64 to 80% saturated. Fetal hemoglobin is said to have a greater affinity than adult hemoglobin for oxygen at low partial pressures.

The following changes occur in fetal circulation at birth:

1. Occlusion of the placental circulation is promptly affected by the constriction of the umbilical arteries, so no more blood can leave the fetus.
2. As indicated previously, much of the blood in the placenta can drain back to the fetus if the umbilical cord is not clamped immediately; however, once the cord is clamped, the ductus venosus has no functional purpose.
3. Unless a structural deficit is present, the foramen ovale is closed from a functional standpoint within a few minutes. The mechanism by which this occurs is not clearly understood.
4. The ductus arteriosus is closed by the activity of its highly muscular walls, the stimulus for closure usually being an increased oxygen content of the blood; but asphyxia can cause the same effect due to the release of sympathetic amines. However, an increased blood oxygen content that is maintained is necessary for the continuing contractions of the ductus arteriosus.

There is some debate on the rapidity with which the ductus arteriosus is functionally closed. One theory recently proposed is that the ductus gradually closes and as the pressure in the pulmonary artery falls, there develops a left to right shunt of a considerable quantity of blood. This supplement to blood in the pulmonary artery is said to help increase arterial oxygen saturation, and the resultant increased pulmonary return to the left auricle aids in keeping the foramen ovale closed.

This all supposedly provides for a smooth changeover from the "fetal" to "adult" circulation. In cases of hypoxia and *asphyxia neonatorum*, the asphyxia increases this left to right shunt for awhile by the increasing arterial blood pressure; but with prolonged asphyxia, circulatory failure ensues and the benefit of an open ductus is lost. This is due to the fact that failing arterial blood pressure cannot maintain the left to right shunt—in fact the shunt returns to the fetal state of right to left. Thus blood is directed away from the lungs; also the right atrial pressure becomes elevated and blood once more can pass through the foramen ovale to left atrium.

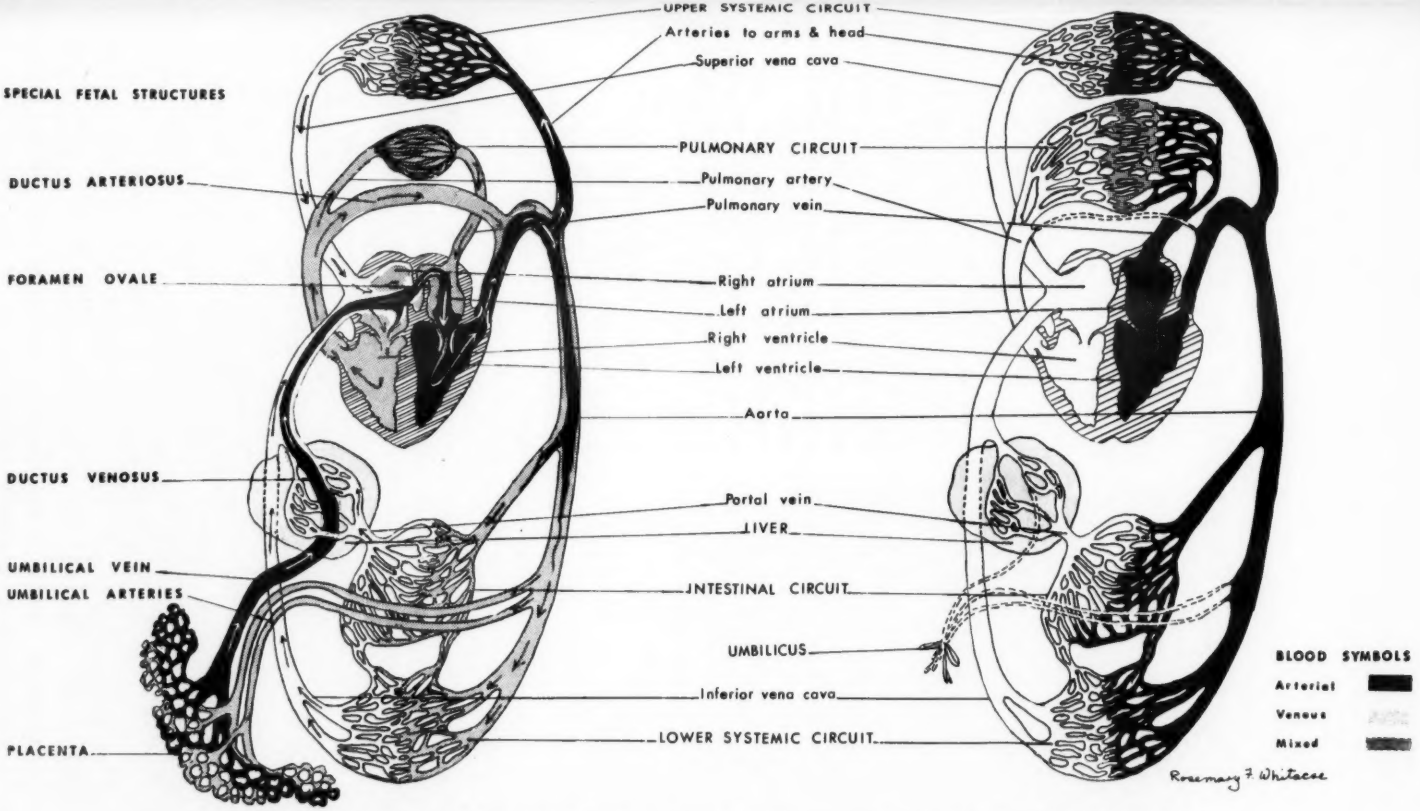
The fetal circulation is now re-established, with the development of a vicious cycle of increasing anoxia, respiratory distress, and circulatory failure with death imminent unless the situation is reversed.

There has been considerable discussion in the literature about the fetal lungs and respiratory activity *in utero*. The fetal lungs are compact and "gland-like" in structure. The bronchi and bronchioles

continued on page 20

The subject of resuscitation of the newborn is one about which much has been written, but many conflicting theories have been proposed, and agreement has been reached only on some of the basic principles. All this "wealth" of material indicates that much is not known about changes occurring in the infant at birth.

Dr. Knox first reviews for us some of the physiological and anatomical facts concerning the circulatory and respiratory systems of the fetus during intra-uterine life, and the changes that occur at birth. Our next issue will carry his pointers on the actual resuscitative procedures.—Ed.



Schematic diagrams of the fetal (left) and adult (right) circulatory systems, emphasizing the peculiar features of the former which permit respiration without the lungs in utero.

Note difference in size of pulmonary circuits, due to absence of blood from the fetal one. Note also difference in blood composition in pulmonary vein, the lower systemic and intestinal circuits—mixed in the fetal, but arterial in the adult circulation.

These changes are due to the closing at birth of the foramen ovale, ductus arteriosus, ductus venosus and the umbilical vessels. Normally these events occur within the first 24 hours of post-natal life.

Oxygen Tents Go Streamlined At Johns Hopkins

by William L. Siegman
Chief Inhalation Therapist
Johns Hopkins Hospital, Baltimore, Maryland

OLDER oxygen administration methods have given ground to the inexpensive open-top face tent at Johns Hopkins. In 1959, with an average of 30 patients receiving oxygen simultaneously in the hospital, sixteen received oxygen through open-top face tents, nine by refrigerated tents, three by catheter, and two by face mask. The current trend in favor of the open-top face tent is primarily based on its operating simplicity, ability to maintain adequate concentrations, patient comfort, and low maintenance costs.

Because of its simplicity, the face tent requires practically no maintenance outside of routine cleaning after use. After being used, face tents are brought into the oxygen therapy department and checked for damage. At this time the damaged units are discarded. The face tents and tubing are washed and placed in an antiseptic solution for sterilization. After air drying, they are put in a glass-door cabinet in the oxygen therapy department for storage. Proper care has made it possible to use each open-top face tent several times before it is discarded.

The open-top design of the face tent provides a significant safety factor because even if the gas flow is blocked, atmospheric oxygen will be available to the patient. In addition, the face tent eliminates concern about the possibility of oxygen toxicity from the inhalation of high concentrations of oxygen, or the occurrence of apnea in the patient with CO_2 narcosis whose remaining hypoxic drive for respiration is removed by inhalating oxygen of too high concentration.

A number of patients will tolerate neither mask nor nasal catheter, and make it necessary to tie up expensive electric tents which are not actually indicated. In such a case, the patient will tolerate a face tent with very little difficulty. It has also been observed that some patients who are extremely apprehensive tend to exhibit less anxiety with a face tent than with the larger and better-known oxygen tent.

The use of the face tent has not been restricted to any particular type of patient; however, it is used most frequently on post-operative cases. The face tent is particularly useful on those patients who require a large degree of nursing care; frequent pulse and blood pressure determinations and the need for intravenous feeding or medication, etc., drastically reduce the concentration within a canopy, which must be opened and closed to provide the necessary service.

The post operative patient often requires the insertion of a Levine tube in one nostril. The use of nasal oxygen will cause both nostrils to be occupied, and the drainage tube will interfere with alternating the nasal catheter between nostrils to relieve nasopharyngeal irritation. In these instances, face tents allow the patient to receive the proper amount of oxygen regardless of nursing care, and with a minimum of discomfort. As the patient's condition changes, it may be desirable to utilize some other type of apparatus.

The face tent, currently available from many suppliers, fits comfortably over the lower portion of the patient's face and is open wide at the forehead to allow the escape of exhaled gases and vapors. Constructed from flexible, clear plastic, the unit is supported by an adjustable plastic headstrap. Its weight is only 1¼ ounces. It can be easily removed for washing and feeding, and constant attendance or expert supervision is unnecessary. Simultaneous Wangensteen suction drainage or Miller-Abbott tube feeding can be performed where indicated.

Humidified oxygen enters the fact tent through a shower-head dispersal system that eliminates many of the discomforts present with nasal catheters and face masks. A continuous flow of oxygen replaces the consumed gas, and CO_2 and warmed vapors flow out readily through the open top of the face tent. The flow of atmospheric air through the open top along with the oxygen entering the mask provide adequate dilution of CO_2 to a safe level.

Breathing, as well as visibility, is completely free and unobstructed at all times. Rarely has a complaint been made of claustrophobia or unpleasant odor.

"This photo shows the face tent being used with large bore tubing as an aerosol mask. When used for oxygen with standard humidification, the smaller input nipple is used."—Photo courtesy NCG

EMERSON "UCYCLIT-B" Respirator

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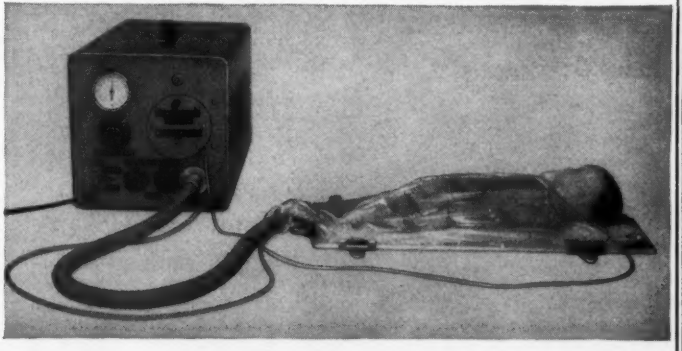

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Effective Therapy Requires Integrated Efforts of Nursing Team and Therapists

by Joan K. Grayson, R.N.

THE phenomenal growth of inhalation therapy places great demands on all those responsible for patient care. A U. S. National Health Survey for the year ending in June 1958 showed that approximately 2¼ million persons were hospitalized in that time due to respiratory illnesses. The use of inhalation therapy in the treatment of acute and chronic diseases of the lungs is expanding rapidly. Research has advanced this therapy at such a pace that it has been difficult for the medical and nursing professions to keep abreast of it. There has been a particularly rapid growth of therapy in the past 10 years. Approximately 175,000,000 cu. ft. of oxygen is sold each month to hospitals in the United States, mainly for administration to patients. This is the equivalent of approximately 717,000 large cylinders ("K" or "G" size.) Twenty-five years ago, the use was approximately 5,000,000 cu. ft. or 20,000 large cylinders per month.

Mrs. Grayson is Oxygen Therapy Consultant for the Linde Company, a Division of Union Carbide Corporation, New York. She is also on the faculty of the School for Inhalation Therapists at St. Elizabeth Hospital in Elizabeth, New Jersey.

Important advances in the use of oxygen and inhalation therapy are being reported monthly in the medical journals. Advances have been made in the use of oxygen in the medical complications of pregnancy, in treating diseases of the aged and in rehabilitation of the aged, to mention only a few.

Total patient care is the end result of a number of groups within the hospital working together, and functions of these groups necessarily overlap. At the head of the health team is the physician who determines the patient's therapy needs. The nursing team is under the command of the registered nurse, and the physician depends on her to see that his prescription for the patient is fulfilled. The inhalation therapist is an auxiliary member of the nursing team upon whom the nurse depends for assistance in administering the therapy. Both the nurse and the therapist must know what is required for the ther-

apy and the correct technique of application. Both must understand the patient's need, the function of the apparatus, and be aware of the desired results. To obtain good results, the nurse and the therapist must work closely together toward one basic goal—to do at all times what is best for the welfare of the patient.

Staff must be organized

There are a number of elements that go to make up safe and effective therapy and, in order that the nurse and therapist may efficiently function together, the divisions of responsibility must be recognized and provisions made for molding them into a smoothly functioning whole.

The initial responsibility for providing a good inhalation therapy service rests with the hospital administration. This important medical specialty cannot be handled out of a hall closet nor can it operate without specific medical and technical supervision. The days of having apparatus scattered all over the hospital with no central control point are over. Hospitals have learned the hard way that this is uneconomical because valuable apparatus is unintentionally mishandled and misplaced, and is seldom ready for immediate use when needed.

The medical supervisor of the therapy provides leadership and guidance for the medical staff so that patients will receive the best possible therapy according to current standards. He also acts as liaison between the therapist and technicians. The therapist is the technical supervisor of the service and technicians are trained by him and function under his direction.

The hospital administration should further be responsible for setting up the policies under which the Inhalation Therapy Department will operate. The chain of command should be determined, responsibility clearly designated and effective communications established among all parties.

Communications must be adequate enough to cover all facets of the therapy procedure. The prescription is a form of communication and it must be complete. It should be detailed and clear enough for the nurse and therapist to know what apparatus to use and how much oxygen to give. You have probably seen a prescription such as "start O_2," which is very inadequate. It lacks the type of apparatus to be used, the concentration or dose of oxygen, the frequency and length of the treatment. It places unfair and unqualified responsibility upon the nurse or therapist. To provide a clear guide, the prescription should include the method of administration, concentration of oxygen, and the duration of the treatment (continuous or intermittent). Special medications for aerosol therapy should be ordered in the usual manner. When pressure breathing is used, the amount and type of pressure required should be named. Standing orders for inhalation therapy covering the use of each type of apparatus should be established by the medical supervisor. The standing order should have the general approval of the medical staff with the understanding that it will be followed in all instances where a specific order is lacking.

Orders should give details

After receiving the prescription, the nurse notifies the Inhalation Therapy Department that therapy has been ordered and requests the necessary apparatus. It is the responsibility of the therapist to assemble the correct apparatus and set it up at the bedside of the patient. Preparation of the patient is a most important part of effective therapy. Responsibility is shared by the physician, and the nurse and therapist. The physician tells the "why" and "how." If the patient knows why the treatment is needed he will accept the treatment more readily. The therapist explains the mechanics and basic principles of the apparatus. The nurse enhances the teaching done by the others so that the patient will be relaxed and free from unnecessary fears and can obtain maximum benefit from the treatment. Successful patient care depends in large part on the trust and understanding that is developed between the patient and those attending him.

continued on page 30

continued from page 14

have a definite lumen while the more distal air passages and alveoli do not. The alveoli are lined with cuboidal or low columnar epithelium; and only after breathing is instituted or amniotic fluid distends the alveoli, does the alveolar lining assume the "adult" type, namely, a single layer of squamous epithelium.

The somatic motor nerve system concerned with respiration has its genesis early in embryonic life; soon higher neurons are formed and brought into a mutually integrated center to comprise the respiratory center. Appropriate stimuli (such as afferent nervous discharge into the respiratory center, carbon dioxide acting directly on the center, and anoxial enhancement of its excitability) can bring this center into premature activity. However, it is doubtful if this respiratory mechanism functions in the strictly normal course of intrauterine life.

Respiratory movements have been noted as early as 12 weeks in the human fetus; however, this was coincident with the interruption of the placental circulation. The variety of respiratory movements, with or without the aspiration of amniotic fluid, which occur *in utero* are probably associated only with asphyxial states. However, some investigators feel that respiratory activity starts *in utero,* and at birth breathing is just a continuation of this activity, but with air being moved in and out of the lungs instead of amniotic fluid.

The majority opinion is that respiratory activity starts at birth. The stimuli for initiating respiration at birth are not definitely established, but it is believed probably anoxia, hypercarbia and afferent stimuli from the changed environment may be responsible.

In the newborn full term infant, the respiratory rate is 40-60 times/minute; tidal volume is 18-25cc, and respiratory minute volume is 700 to 1500 cc.

For respiration to begin at birth and to continue unabated, the following are considered essential:

1. An active and receptive respiratory center which in turn is capable of emitting rhythmic stimuli.
2. Intact nervous pathway along which these stimuli can be transmitted to the muscles of respiration.
3. Respiratory muscles that are able to receive stimuli and respond accordingly.
4. A clear airway.
5. Alveoli with the capacity to receive air and distend appropriately.
6. A pulmonary capillary bed sufficiently mature to receive and absorb oxygen.
7. Adequate supply of oxygen in the inspired air.
8. An uninhibited exchange of gases between the alveoli and the pulmonary capillaries.
9. A cardio-vascular system that functions adequately.

This integration of the nervous, respiratory and cardio-vascular systems may have its continuity interrupted at any point; so that at birth there will be a hypoxic or apneic infant who may, in turn, develop permanent central nervous system damage or die.

Asphyxia neonatorum is the term used for a newborn infant who fails to breathe at birth. Actually, in its strict definition, *asphyxia* (as derived from the Greek) means absence of pulsation. However, over the years it has become associated with suffocation and apparent death. (*Asphyxia* frequently denotes anoxia and concurrent hypercarbia.) *Apnea neonatorum* might be a better term.

In 1954, the death rate for newborn infants in the first 24 hours of life was over 50,000. Over the past 40 years, there has been very little reduction in this rate, *apnea neonatorum* comprising about 50-60% of all causes.

The immediate cause of *apnea neonatorum* is usually a depressed or damaged central nervous system due most often to cerebral hemorrhage, intrauterine anoxia

or other agents causing direct central nervous system depression.

The basic etiological factors may be classified into maternal, fetal or obstetrical causes:

I. Maternal factors: There has been noted an increased incidence of *apnea neonatorum* with mothers over 40 years of age, with great multiparity and with certain diseases of the mother. Some of the diseases implicated are heart disease, anemia, pulmonary diseases, metabolic diseases and toxemias of pregnancy.

II. Fetal factors: Included in this group are malformations of the respiratory and cardiovascular system, diaphragmatic and other abnormalities—especially those of the head and neck. Immaturity is a great factor, but many conditions of the mother cause premature birth.

III. Obstetrical factors: Included under this classification are abnormalities of the uterus and placenta, as well as factors associated with labor and delivery.

The presentation and position of the fetus during labor is occasionally a factor, there being an increased incidence of *apnea neonatorum* with breech presentation and transverse and occiput posterior positions. Prolonged labor is definitely a factor, especially when associated with borderline or cephalopelvic disproportion. Abnormalities of the placenta include gross infarction of the placenta, low insertion, *placenta praevia*, premature separation, prolapse of the umbilical cord, kinking or knotting of the cord, the cord wrapped around the infant's neck – also uterine tetany and contraction rings.

The usual signs of intrauterine fetal distress are a sustained heart rate below 100 or above 160, irregular heart rate, and meconium-stained amniotic fluid.

During actual delivery, the obstetrical maneuvers implicated are breech delivery, version and extraction, mid-forceps (this carries about 25% mortality), cesarean section, and low forceps without an episiotomy.

Analgesic agents are often a cause of temporary apnea at birth (as are general anesthetic agents). Without the use of hypnotics and narcotics for sedation and pain relief during labor there is an incidence of respiratory distress of only 1.9%. But by the careful and judicious use of these agents during labor, very little difficulty is experienced except with large dosage and administration too close to delivery.

As is well known, anesthetic agents can play an important part in depression of the newborn—except possibly for local infiltration with or without pudendal block, but even here a toxic reaction is possible. This last named method is probably the safest when someone trained in anesthesia is not available. Regional anesthesia (usually saddle block or caudal) might be considered the method of choice in experienced hands. All general anesthetic agents will pass to the fetus; here time plays an important role in the degree of depression as does depth of anesthesia. In a recent series which included 756 deliveries done under spinal anesthesia and 457 under general anesthesia, and both groups using the same sedation, the incidence of a depressed infant was significantly higher in the group receiving general anesthesia, and low in the spinal group despite premedication. Some other facts about anesthesia as related to labor and delivery are:

1. Relaxants are of no value in relaxing a contracted uterus.
2. No anesthetic agents used will relieve cervical dystocia.
3. If labor is well established, no drug will stop it.
4. No method of pain relief will increase the length or strength of uterine contractions.

Also the statement has been made that, whereas cyclopropane provides good oxygenation of the mother, fetal oxygenation is poor (due perhaps to opening of A - V shunts in the uterus).

***The statements made herein do not necessarily reflect the opinion of the Navy Department.**

Part II will appear in the June issue

ABSTRACTS

"Dangerous Dusts and Furtive Fumes," an Editorial in *J.A.M.A.*, 5 Nov 60 (174:1320), reviews some interesting "new" pulmonary disorders being encountered as occupational hazards in recent years.

One of them described about four years ago by Lowry & Schuman in *J.A.M.A.* (162:153, 1956) was called "silo-filler's disease," and appears to be caused by the poisonous Nitrogen Dioxide gas released in the fermentation of the corn ensilage inside the closed silos. (See also "Nitrogen Dioxide Pheumonia," by R. R. Grayson, M.D., in November 1957 *GP*, abstracted in *Inhalation Therapy*, December 1957). It produces an acute pulmonary edema and bronchiolitis, which peculiarly recurs after apparent recovery.

Another, dubbed "farmer's lung" in a more recent report by Dickie & Rankin in *J.A.M.A.* (167:1069, 1958) is marked by chills and fever, headache, malaise, dyspnea, cyanosis, cough and hemoptysis. Here the causative agent appears to be mold spore-laden dusts of hay, grain, fodder, etc., and the result is an acute granulomatous interstitial pneumonitis.

At about the same time, Bergmann, Flance & Blumenthal published an account (*New Engl. J. Med.*, 258:471, 1958) of what they term *pulmonary thesaurosis*, arising in women from the inhalation of hair spray. Here it is evidently not the solvent-propellant agent used in the aerosol, but rather some resin molecules too large to pass through the kidneys which are therefore deposited in lymph tissues, including the lungs.

Still more recently (*J.A.M.A.* 171:15, 1959), Bringhurst, Byrne & Gershon-Cohen reported a clinical entity known as *mushroom worker's disease*, which symptomatically is about like farmer's lung. The etiologic agent here seems to be horse manure compost, which can generate some nitrogen dioxide, but which also is covered with a mold which is even more suspect.

In a current paper by Buechner (*J.A.M.A.*, 174:1237, 1960), the condition called *bagassosis* is described. It appears to be caused by inhalation of the dust of bagasse, the sugar cane fibre used in some factories manufacturing paper or fiberboard. The symptoms are about the same as those of farmer's lung, of which this may be merely a variant, as the dusts are similar in nature.

Thus, to the older inhalational diseases like anthracosis, silicosis and asbestosis, we are adding these new ones, and as the editorial points out, "the list of these inhalational disorders continues to grow." Some evidently are due to irritation or toxicity directly attributable to the dust particles themselves; others to fungus or mold spores that accompany the dust; and others, perhaps, to agents as yet unidentified.

"The Mechanism of Breathing," by Wallace O. Fenn, Ph.D., in *Scientific American*, 202:138, 1960.

Unlike papers in a medical journal, documenting research or clinical case histories, here is an expository essay on the marvelous machinery by which we effect respiration. Written by one of the world's leading respiration physiologists, it is profusely and interestingly illustrated, and contains some remarkably clear explanations of the pressure relationships in the lungs which have baffled students for many years.

An example of the way in which the information is conveyed, is the following quotation: "With a microscope one can see that the smallest branches (of the bronchi), the bronchioles, end in many small sacs, the alveoli. Where the routes to the alveoli from the trachea are short, the tubes are apparently smaller in diameter; as a result all of the alveoli, regardless of their distance from the trachea, tend to expand simultaneously—a neat engineering trick!"

There is an enlightening discussion of the pressure-volume curves of the lung. When the volumes of air contained in the lungs at different pressures are plotted on a graph, a whole family of such curves is obtained; the three most significant are the ones representing the situation when all the inspiratory muscles are maximally contracted, all the expiratory muscles maximally exerted, and the mid-point between these extremes, where all of both sets of muscles are relaxed. These curves, as he says, "have a significance that goes beyond pressure-breathing. In fact, they describe the mechanical limits of the breathing apparatus more or less completely."

The relationship of the pleural covering of the lung and lining of the chest cavity is carefully developed, using interesting details this reviewer has not seen in standard texts treating the subject.

In discussing the work of breathing, Dr. Fenn says that for one breath, it is "equivalent to raising one pound 1½ inches," and "the effort required to renew the air in the lungs is negligible, and energy to sustain it can be supplied (at 5% efficiency) by two lumps of sugar or their equivalent per day."

Regarding the old rapid-shallow versus slow-deep respiratory patterns, it is pointed out that

whereas the rapid-shallow technique does not give enough alveolar ventilation with respect to the amount of dead-space ventilation, the slow-deep method is more tiring because it requires more work. ("The pressure-volume diagram shows that the work done with each breath increases as the square of the volume.") Hence a compromise is the most satisfactory. When such a mid-way compromise is calculated, the answer for the most ideal work efficiency: good ventilation relationship is approximately 15 breaths per minute, each of about 500 cc volume. Lo and behold! the average respiratory rate and volume for the adult male "happens" to be just that.

There are fascinating descriptions of the osmotic pressure "pump" that regulates the amount of fluid in the intrapleural space, and of the action of the cilia of the respiratory epithelium, of the events going on during coughing, sneezing and other maneuvers such as yawning.

—J.F.W.

FILM REVIEW

"HYPOXIA – INDICATIONS FOR OXYGEN THERAPY," *by the Linde Company.* A new medical film, presenting a general survey of the causes and effects of hypoxia, has been prepared by the Linde Company, Division of Union Carbide Corporation. Presented by Edwin Rayner Levine, M.D., it reviews the basic physiology of respiration and demonstrates clinical recognition of the major types of hypoxia. Augmenting this series of actual clinical examples is a sequence of animated diagrams which surveys the causes of hypoxia.

After reviewing apparent symptoms of hypoxia induced by exercise in a normal adult, Dr. Levine discusses true hypoxia in asthma, broncho-pneumonia, pulmonary edema, and in typical post-operative patients. After pointing out the use of oxygen for these conditions, the film features an unusual photographic sequence of tissue hypoxia produced by coronary artery ligation, in a dog's heart, and its improvement by oxygen inhalation.

Most doctors encounter hypoxia with great frequency in daily practice. Their early recognition of hypoxia has resulted in an increase of treatment for oxygen deficiency. This film's presentation of how to recognize and treat hypoxia makes it of great importance to all doctors who encounter clinical hypoxia whether they are specialists or GPs.

This 30 min., 16 mm., color, sound motion picture was produced by Dynamic Films, Inc., New York. It is available on free loan from your local Linde oxygen therapy representative, or directly from Dept. HF, Linde Company, 270 Park Avenue, New York 17, N. Y. Due to a great demand for showings, please specify an alternate showing date.

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CHAPTER ACTIVITIES

by Howard R. Dockham

Chapter Secretaries: Please send reports and notices to the new address:
Howard R. Dockham
4618 East Douglas
Tucson, Arizona

The GREATER NEW YORK CHAPTER elected new officers at their January 18th meeting, as follows: President, Warren Greer; Vice-President, Joseph Klocek; Treasurer, William Jones; Secretary, Irving Edelson.

At the January 18th meeting of the SOUTHERN CALIFORNIA CHAPTER elections were held for the new year. New officers are: President, Mr. Gilbert Griffen; Vice-President, Mary Margerison; Secretary-Treasurer, Lillian Van Buskirk; Members of the Board, Mr. Charles Tate and Lenora Brenton. At the February meeting, President Griffen announced the election of Walter L. Jones, Senior Inhalation Therapist at UCLA Medical Center, to the Board of Directors for a three year term.

The ROCKY MOUNTAIN CHAPTER also held elections at their January 19th meeting. President is Mrs. Grace G. Beezley, LPN; First Vice-President, Mr. Jones H. Harper; Second Vice-President, Mrs. Jeannette L. Stark, RN; Secretary, Mrs. Vivian F. Curtis, RN; Treasurer, Mrs. B. Beverly Randall; and Assistant Secretary-Treasurer, Mrs. Susan L. Cocharo, LPN.

At the January 17th meeting of the DELAWARE VALLEY CHAPTER, the following officers were elected for 1961: President, Mr. George Jester; Vice-President, Mr. Robert Knause; Secretary-Treasurer, Mr. Robert Waters; and Board Member, Mr. Walter Palmer. A chapter project was announced by Mr. Palmer: permission has been granted by AAIT Headquarters for the sale of "Leafax" booklets and Zippo lighters by the chapter. A committee of three was appointed to implement the details of this project.

The MICHIGAN SOCIETY OF INHALATION THERAPISTS has completed plans for their third annual workshop, to be held April 6th at the Hayes Hotel in Jackson. Speakers from New York, Cleveland and Chicago, as well as from several places in Michigan, will be covering a wide range of topics from "Fun and Hazards of Skin Diving" to "Nebulized Solutions and Cold and/or Tepid Mists." A special feature will be the showing of a larger-than-life mannikin equipped with a special lighting system to illuminate in sequence the muscles used in either resting or active respiration.

Presentation of the Southern Illinois Chapter Charter, left to right, Luther Platt, Sister Rudolpha and Mr. Carriere.

A new chapter has been formed in Springfield, Illinois, called the SOUTHERN ILLINOIS CHAPTER. Officers are: President, Luther Platt; Vice-President, Henry Obernuefemann; Secretary-Treasurer, Carl Stolleis.

The Treadway Inn Motel in Batavia, New York will be the setting for the third annual institute of the WESTERN NEW YORK CHAPTER on May 25th. Plans are not yet completed, but one new feature will be concurrent sessions in order to meet the needs of two distinct groups of registrants: the chapter members and others engaged directly in this work, and visitors not yet experienced in the field.

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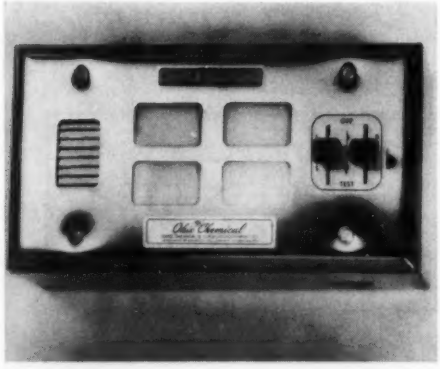
EQUIPMENT NEWS

(Information and photographs are supplied by the manufacturers or distributors.)

Audible and Visual Alarm

Ohio Chemical & Surgical Equipment Co. (a Division of Air Reduction, Inc.), Madison, Wis. offers new combination alarm panels, incorporating both audible and visual warning signals. One of the most recently developed ones combines "Operating" and "Emergency" indicating devices. The "Operating" signal indicates when switch-over occurs from the *in-service* to *reserve* supplies of oxygen or nitrous oxide. The "Emergency" signals indicate an abnormally high or low line pressure.



A "Normal" light is part of every Ohio alarm panel. It remains lighted to assure personnel the pipeline is functioning properly.

Several types of auxiliary alarm panels are available to meet specific requirements, since each pipeline installation is custom-designed for the individual hospital. Switches in each alarm panel permit testing of the warning signal components. **No. 621**

Various Mountings for Vacuum Bottle

The Ohio Chemical & Surgical Equipment Co. (a Division of Air Reduction, Inc.) now offers a variety of mountings for their new vacuum bottle trap units. The units are available with or without the vacuum regulator and gauge for mounting on the wall at eye level, or in a specially designed floor carrier. The wall-mounted units are attached to a bracket which fastens directly to the wall or may be used with a wall mounted slide provided with Ohio "Diamond" outlets.

The floor carrier has three conductive rubber casters and the bottle is held firmly in the stainless steel carrier by three rubber spacers. The regulator and gauge are separate from the bottle and cap assembly to facilitate easy removal of the bottle for cleaning.

Vacuum gauges are calibrated from 0 to 200 mm Hg. with a large easily accessible adjustment knob. All metal parts are chrome plated or corrosion-resistant. **No. 622**

Emergency Cart

An emergency cart that enables personnel to supply oxygen, suction or air more quickly to a patient, before arrival of a therapist or doctor, is offered by the National Cylinder Gas Division of Chemetron Corporation.

The unit is a rubber-wheeled metal table with drawer. It is equipped with an oxygen regulator, a pump which provides compressed air or suction, and yoke headers equipped with check valves so that E cylinders may be replaced during use.

The "Ox-Cart," as it is named, can be loaded with such administrative equipment as resuscitators, masks, face tents, tubing, humidifiers and nebulizers. Apparatus plugged into outlets on the cart may be transferred immediately to wall outlets so that the cart may be returned to its station for other emergencies. **No. 623**

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Are These References on Your Shelf?

by James F. Whitacre

With growing interest in education, we receive more and more questions about where information is available. The plain fact is that textbooks written expressly for therapists are very few. Until some are produced, we need, therefore, to get as much as we can from the books written for doctors. Some of these are couched in such medical terms as to be unintelligible to lay readers; and some of them devote only small sections to the practical aspects of therapy.

The following is by no means a complete listing of books on the subject of inhalation therapy – there were several others reviewed in last June's issue of INHALATION THERAPY—but is a guide to the contents of a representative group of them. They are presented in alphabetical order of the authors' names. Following the author's name is the title, the publisher and publisher's city, and the year of publication. Brief comment on the contents follows each listing.

1) Andrews, Albert H., Jr., M.D., MANUAL OF OXYGEN THERAPY TECHNIQUES, Yearbook Publishers, Chicago, 1947.

As old as it is, this little uniform-pocket-size book contains much practical information still of use to the therapist. Its opening chapters deal with such solid factual material essential to the practice of inhalation therapy as the sizes, styles and color coding of cylinders available, how much they will hold of different gases when full –in terms of cubic feet, liters or gallons, with conversion factors for getting from one unit to another. There are tables showing how long the gas from a given size cylinder will last at various rates of flow, and a formula for calculating this from the pressure remaining in a large cylinder at any time. It gives important information about regulators, flowmeters, fittings and manifolds for bulk gas pipeline systems. Then there are chapters detailing the techniques of using

With up-dating and new equipment illustrations, this book would be the definitive technical work for the therapist, because it is one of the two or three written just for him, and does not contain a lot of discourse on medical matters the beginner is not yet ready for.

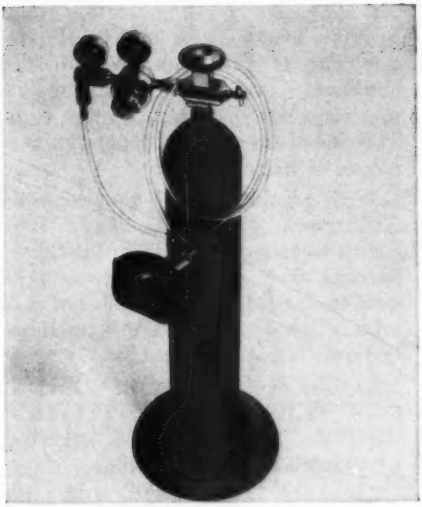
2) Barach, Alvan L., M.D., PHYSIOLOGIC THERAPY IN RESPIRATORY IN RESPIRATORY DISEASFS, 2nd ed., J. B. Lippincott, Philadelphia, 1948.

This book, like Andrews', is also out-of-date equipment-wise, but contains much basic information which will be the same 13 years from now as it was 13 years ago. More than half of the text is devoted to discussion of diseases, directed at the physician's level of educational background. Nevertheless, a therapist with good grounding in anatomy and physilogy will be able to grasp much which will help his understanding of pulmonary disorders. Especially noteworthy in his chapter on methods of therapy is Dr. Barach's warning against assuming any set percent concentration for a given flow of oxygen per minute, because of the variability of the minute ventilation of the patient.

3) Comroe, Julius H., Jr., M.D., and Dripps, Robert D., M.D., PHYSIOLOGICAL BASIS FOR OXYGEN THERAPY, Charles C. Thomas, Springfield, 1950.

This monograph is excellent for giving the therapist a clear picture of the effects of oxygen on various parts of the body; the causes of and types of anoxia, distinguishing between those of pulmonary and those of cardiovascular origin. There are also informative sections on the use of oxygen for conditions unrelated to anoxia, and on the toxicity of oxygen under certain conditions. There is no material on equipment or techniques.

Additional references will appear in future issues.



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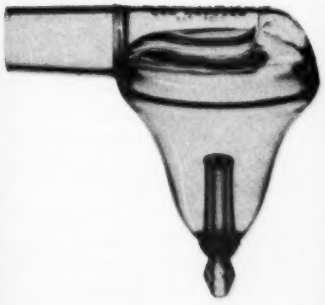

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continued from page 19

The therapist usually starts the therapy and the nurse supervises the care of the patient. The therapist aids her by also observing the operation of the apparatus and the response of the patient. The therapist, because of his constant familiarity with the apparatus, is perhaps more alert to its functional peculiarities. He adjusts it when necessary and advises the nurse of any change in liter flow or technique. He is constantly alert for any hazardous conditions and sees that safety precautions are always followed. The therapist is also responsible for the maintenance of the apparatus and he cleans and disinfects it after use.

Another important means of communication is the Case Record of the therapy. This usually is kept jointly by the nurse and technical staff with each team member recording pertinent observations. The Case Record is needed by the physician for clinical evaluation of his patient's condition. It is needed as a communication between the nurse and the therapist and other persons attending the patient. For instance, it is important that nasal catheters be changed at least once every eight hours. The time of change should be marked on the patient's chart as a matter of record. Good records are essential for the carrying out of research and are also needed by the Business Office so that proper charges for the service may be levied. Records show that the prescription is being fulfilled and they show how the patient is responding to the treatment. Most hospitals are now adding a special Oxygen Therapy Case Record to their charts.

In addition to records of therapy, there are other tools of communication which should be used to keep all personnel abreast of inhalation therapy:

1. Written directives
2. Orientation lectures for new personnel
3. Consultations and conferences
4. In-service programs for both medical and nursing personnel.

The members of the health and nursing teams, both as a group and as individuals, must make a concentrated effort to keep up with the advances in this field in order to bring safe and effective therapy to the patient. The fact that you are reading this indicates your awareness of this need, but being well informed is not enough. You must also make every effort to coordinate your activities and efficiently communicate with each other. It is imperative that you know and understand the functions and responsibilities of the other members of the team as well as your own. The patient is our primary concern and it is toward his welfare that all activities are directed.

AMERICAN ASSOCIATION OF INHALATION THERAPISTS

THE AMERICAN ASSOCIATION OF INHALATION THERAPISTS is an organization of therapy technicians working: In hospitals, for firms providing emergency therapy service, and for municipal organizations. The Association is sponsored jointly by the American College of Chest Physicians and the American Society of Anesthesiologists. Three doctors from each group comprise the joint Board of Advisors to the AAIT, which has nearly 1,000 members in the United States, Canada, and several countries abroad.

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